WHAT IS CLAIMED IS:

1. A radio receiver system comprising:

a radio receiver which receives plural modulated radio frequency carriers and produces therefrom a modulated base-band signal, the plural modulated radio frequency carriers having been transmitted by a radio transmitter operating in accordance with a transmitter sample clock;

a receiver sample clock which is used for sampling the modulated base-band signal; and

a timing correction unit which performs in the frequency domain a timing drift compensation between the transmitter sample clock and the receiver sample clock.

2. The apparatus of claim 1, wherein the plural modulated radio frequency carriers have been modulated using Orthogonal Frequency Division Multiplexing (OFDM).

3. The apparatus of claim 1, wherein the timing correction unit performs the timing drift compensation using a frequency estimation and frequency domain channel estimation.

4. The apparatus of claim 3, further comprising a demodulation section which comprises the demodulator and the timing correction unit, and wherein the demodulation section further comprises:

a frequency offset estimation unit which outputs a frequency offset estimation;

a frequency correction unit which receives the modulated base-band signal and outputs a frequency corrected modulated base-band signal;

a fast Fourier transform (FFT) unit which receives the frequency corrected modulated base-band signal and outputs a frequency domain modulated subcarrier signal;

a channel estimation unit which uses the frequency corrected modulated base-band signal to generate a frequency domain channel estimate which is applied to the timing correction unit;

wherein the timing unit generates a time corrected channel estimate;

a demodulator which uses the frequency domain modulated subcarrier signal and the time corrected channel estimate to generate a demodulated signal.

5. The apparatus of claim 4, wherein the timing correction unit estimates a timing drift value and compensates for the timing drift value in the frequency domain by applying an appropriate phase factor to a subcarrier to update the channel estimate and thereby provide a time corrected channel estimate.

6. The apparatus of claim 5, wherein the timing correction unit updates the channel estimate using a relationship

$$H_m[k] = \exp(j \cdot \phi_{m,k}) \cdot H_m[0]$$

wherein:

$H_m[k]$ is the time corrected channel estimate for a time index measured in data symbols k; $H_m[0]$ is the frequency domain channel estimate for the data symbol k; $\varphi_{m,k}$ is the phase factor; and wherein m is a subcarrier index for used subcarriers.

7. The apparatus of claim 6, wherein the phase factor $\varphi_{m,k}$ is defined by the following expression:

$$\phi_{m,k} = \frac{(T_S \cdot (k-1) + T_{init}) \cdot t_0}{T} \cdot \frac{m}{32} \cdot \pi$$

wherein:

m is the subcarrier index;

k is the time index measured in data symbols;

T_s is a symbol time;

T is a sample time;

T_{init} is a time between a reference time and a first data symbol; and

t_0 is the timing drift value.

8. The apparatus of claim 7, wherein the timing drift value t_0 is derived from the following relationship:

$$t_0 = \frac{f_{off}}{f_c}$$

wherein f_{off} is an absolute frequency offset estimate in Hz, and f_c is a carrier frequency in Hz.

9. The apparatus of claim 4, wherein the frequency offset estimation unit is a preamble directed frequency offset estimation unit which receives the modulated base-band signal.

10. The apparatus of claim 9, further comprising a decision directed frequency offset estimation unit which is connected to receive respective inputs from the demodulation unit, the timing correction unit, and the fast Fourier transform (FFT) unit.

11. The apparatus of claim 4, wherein the frequency offset estimation unit is a decision directed frequency offset estimation unit which is connected to receive respective inputs from the demodulation unit, the timing correction unit, and the fast Fourier transform (FFT) unit.

12. The apparatus of claim 4, wherein updating of the channel estimate for the timing drift compensation occurs every M^{th} symbol.

13. The apparatus of claim 12, wherein a value for M is selected based on a particular link adaptation mode.

14. The apparatus of claim 1, wherein the timing drift compensation is performed based on frequency offset estimation and wherein a timing drift compensation value is applied to a frequency domain modulated subcarrier signal.

15. The apparatus of claim 14, further comprising a demodulation section which comprises the timing correction unit, and wherein the demodulation section further comprises:

a frequency offset estimation unit which outputs a frequency offset estimation;

a frequency correction unit which receives the modulated base-band signal and outputs a frequency corrected modulated base-band signal;

a fast Fourier transform (FFT) unit which receives the frequency corrected digital complex modulated base-band signal and outputs, for each subcarrier, a frequency domain modulated subcarrier signal which is applied to the demodulator;

a channel estimation unit which uses the frequency corrected modulated base-band signal and generates a frequency domain channel estimate;

wherein the timing unit receives the frequency offset estimation and the frequency domain modulated subcarrier signal to generate a time corrected frequency domain modulated subcarrier signal;

a demodulator which uses the time corrected frequency domain modulated signal and the frequency domain channel estimate to generate a demodulated signal.

16. The apparatus of claim 15, wherein the timing correction unit estimates a timing drift value and compensates for the timing drift value in the frequency domain by applying an appropriate phase factor to a subcarrier to update the frequency domain modulated subcarrier signal and thereby provide a time corrected frequency domain modulated signal.

17. The apparatus of claim 16, wherein the timing correction unit updates the frequency domain modulated signal using a relationship

$$R_{TD,m}[k] = \exp(-j\phi_{m,k}) \cdot R_{FFT,m}[k]$$

wherein:

$R_{TD,m}[k]$ is the time corrected frequency domain modulated frequency domain signal of an m^{th} subcarrier of a k^{th} data carrying symbol; $R_{FFT,m}[k]$ is the frequency domain modulated signal as output by the fast Fourier transform (FFT) unit of the m^{th} subcarrier of the k^{th} data carrying symbol; and $\varphi_{m,k}$ is the phase factor; and wherein m is a subcarrier index for used subcarriers.

18. The apparatus of claim 17, wherein the phase factor $\varphi_{m,k}$ is defined by the following expression:

$$\phi_{m,k} = \frac{(T_S \cdot (k-1) + T_{init}) \cdot t_0}{T} \cdot \frac{m}{32} \cdot \pi$$

wherein:

m is the subcarrier index;

k is the time index measured in data symbols;

T_s is a symbol time;

T is a sample time;

T_{init} is a time between a reference time and a first data symbol; and

t_0 is the timing drift value.

19. The apparatus of claim 18, wherein the timing drift value t_0 is derived from the following relationship:

$$t_0 = \frac{f_{off}}{f_c}$$

wherein f_{off} is an absolute frequency offset estimate in Hz, and f_c is a carrier frequency in Hz.

20. The apparatus of claim 15, wherein the frequency offset estimation unit is a preamble directed frequency offset estimation unit which receives the modulated base-band signal.

21. The apparatus of claim 20, further comprising a decision directed frequency offset estimation unit which is connected to receive respective inputs from the demodulation unit, the timing correction unit, and the channel estimation unit.

22. The apparatus of claim 15, wherein the frequency offset estimation unit is a decision directed frequency offset estimation unit which is connected to receive respective inputs from the demodulation unit, the timing correction unit, and the channel estimation unit.

23. The apparatus of claim 1, wherein the timing correction unit uses a frequency offset to determine a timing drift value, wherein the subcarrier signal comprises a stream of data symbols, further comprising:

a frequency offset estimation unit which calculates:

an estimated phase offset for each data symbol as a function of the data symbol;

a predicted phase offset for each data symbol as a function of the estimated phase offset thereof and an estimated phase offset of a preceding one of the data symbols in the stream;

a predicted sample phase offset for each data symbol as a function of a predicted phase offset of a corresponding one of the data symbol; and

the frequency offset as a function of the predicted sample phase offset for each data signal sample.

24. The apparatus of claim 23, wherein the frequency offset calculation unit comprises:

a phase locked loop for generating the predicted phase offset;

a phase discrimination unit for generating an estimated phase offset for each data signal as a function thereof;

a filter for receiving estimated phase offsets and generating the predicted phase offset for each data symbol as a function of the estimated phase offset thereof and the estimated phase offset of a preceding one of the data symbols.

25. A radio receiver system comprising:

a radio receiver which receives plural modulated radio frequency carriers and produces therefrom a modulated base-band signal, the plural modulated radio frequency carriers having been transmitted by a radio transmitter operating in accordance with a transmitter sample clock;

a receiver sample clock which is used for sampling the modulated base-band signal;

a frequency offset estimation unit which outputs a frequency offset estimation;

a controller which uses the frequency offset estimation to determine an estimated relative sample clock offset, the estimated relative sample clock offset being an offset between the receiver sample clock and the transmitter sample clock.

26. The apparatus of claim 25, wherein the controller is a sleep mode controller which further determines a timing drift during a sleep period of a predetermined duration.

27. The apparatus of claim 26, wherein the sleep mode controller further determines a time until which the receiver is to sleep.

28. The apparatus of claim 26, wherein the sleep mode controller further determines a time until which the receiver is to search for a start of a frame.

29. The apparatus of claim 26, wherein the sleep mode controller further determines a size of a start of frame search window.

30. The apparatus of claim 26, wherein the plural modulated radio frequency carriers have been modulated using Orthogonal Frequency Division Multiplexing (OFDM).

31. A method of operating radio receiver system comprising:

receiving plural modulated radio frequency carriers and producing therefrom a modulated base-band signal, the plural modulated radio frequency carriers having been transmitted by a radio transmitter operating in accordance with a transmitter sample clock;

sampling the modulated base-band signal in accordance with a receiver sample clock;

performing in a frequency domain a timing drift compensation between the transmitter sample clock and the receiver sample clock.

32. The method of claim 31, wherein the plural modulated radio frequency carriers have been modulated using Orthogonal Frequency Division Multiplexing (OFDM).

33. The method of claim 31, further comprising performing the timing drift compensation using a frequency estimation and frequency domain channel estimation.

34. The method of claim 33, further comprising:

generating a frequency offset estimation;

generating a frequency corrected modulated base-band signal;

using a fast Fourier transform (FFT) unit to generate a frequency domain modulated subcarrier signal using the frequency corrected modulated base-band signal;

using the frequency corrected modulated base-band signal to generate a frequency domain channel estimate;

generating a time corrected channel estimate using the frequency domain channel estimate;

using the frequency domain modulated subcarrier signal and the time corrected channel estimate to generate a demodulated signal.

35. The method of claim 34, further comprising estimating a timing drift value and compensating for the timing drift value in the frequency domain by applying an

appropriate phase factor to a subcarrier to update the channel estimate and thereby provide a time corrected channel estimate.

36. The method of claim 35, wherein the channel estimate is updated using a relationship

$$H_m[k] = \exp(j \cdot \phi_{m,k}) \cdot H_m[0]$$

wherein:

$H_m[k]$ is the time corrected channel estimate for a time index measured in data symbols k; $H_m[0]$ is the frequency domain channel estimate for the data symbol k; $\varphi_{m,k}$ is the phase factor; and wherein m is a subcarrier index for used subcarriers.

37. The method of claim 36, wherein the phase factor $\varphi_{m,k}$ is defined by the following expression:

$$\phi_{m,k} = \frac{(T_S \cdot (k-1) + T_{init}) \cdot t_0}{T} \cdot \frac{m}{32} \cdot \pi$$

wherein:

m is the subcarrier index;

k is the time index measured in data symbols;

T_s is a symbol time;

T is a sample time;

T_{init} is a time between a reference time and a first data symbol; and

t_0 is the timing drift value.

38. The method of claim 37, wherein the timing drift value t_0 is derived from the following relationship:

$$t_0 = \frac{f_{off}}{f_c}$$

wherein f_{off} is an absolute frequency offset estimate in Hz, and f_c is a carrier frequency in Hz.

39. The method of claim 34, wherein the frequency offset estimation is obtained from a preamble directed frequency offset estimation unit which receives the modulated base-band signal.

40. The method of claim 34, wherein the frequency offset estimation is obtained from a decision directed frequency offset estimation unit.

41. The method of claim 34, wherein updating of the channel estimate for the timing drift compensation occurs every M^{th} symbol.

42. The method of claim 41, wherein a value for M is selected based on a particular link adaptation mode.

43. The method of claim 31, further comprising performing the timing drift compensation using frequency offset estimation and applying a timing drift compensation value to a frequency domain modulated subcarrier signal.

44. The method of claim 43, further comprising:

generating a frequency offset estimation;

generating a frequency corrected modulated base-band signal;

using the frequency corrected digital modulated base-band signal and generating, for each subcarrier, a frequency domain modulated subcarrier signal;

using the frequency corrected modulated base-band signal to generate a frequency domain channel estimate;

using the frequency offset estimation and the frequency domain modulated subcarrier signal to generate a time corrected frequency domain modulated subcarrier signal;

using the time corrected frequency domain modulated signal and the frequency domain channel estimate to generate a demodulated signal.

45. The method of claim 44, wherein the timing correction unit estimates a timing drift value and compensates for the timing drift value in the frequency domain by applying an appropriate phase factor to a subcarrier to update the frequency domain modulated subcarrier signal and thereby provide a time corrected frequency domain modulated signal.

46. The method of claim 45, further comprising updating the frequency domain modulated signal using a relationship

$$R_{TD,m}[k] = \exp(-j\phi_{m,k}) \cdot R_{FFT,m}[k]$$

wherein:
$R_{TD,m}[k]$ is the time corrected frequency domain modulated frequency domain signal of an m^{th} subcarrier of a k^{th} data carrying symbol;
$R_{FFT,m}[k]$ is the frequency domain modulated signal as output by the fast Fourier transform (FFT) unit of the m^{th} subcarrier of the k^{th} data carrying symbol; and $\varphi_{m,k}$ is the phase factor; and wherein m is a subcarrier index for used subcarriers.

47. The method of claim 46, wherein the phase factor $\varphi_{m,k}$ is defined by the following expression:

$$\phi_{m,k} = \frac{(T_S \cdot (k-1) + T_{init}) \cdot t_0}{T} \cdot \frac{m}{32} \cdot \pi$$

wherein:
m is the subcarrier index;
k is the time index measured in data symbols;
T_s is a symbol time;
T is a sample time;
T_{init} is a time between a reference time and a first data symbol; and
t_0 is the timing drift value.

48. The method of claim 47, wherein the timing drift value t_0 is derived from the following relationship:

$$t_0 = \frac{f_{off}}{f_c}$$

wherein f_{off} is an absolute frequency offset estimate in Hz, and f_c is a carrier frequency in Hz.

49. The method of claim 44, wherein the frequency offset estimation is obtained from a preamble directed frequency offset estimation unit which receives the modulated base-band signal.

50. The method of claim 44, wherein the frequency offset estimation is obtained from a decision directed frequency offset estimation unit.

51. The method of claim 1, further comprising using a frequency offset to determine a timing drift value, wherein the subcarrier signal comprises a stream of data symbols, further comprising calculating:

an estimated phase offset for each data symbol as a function of the data symbol;

a predicted phase offset for each data symbol as a function of the estimated phase offset thereof and an estimated phase offset of a preceding one of the data symbols in the stream;

a predicted sample phase offset for each data symbol as a function of a predicted phase offset of a corresponding one of the data symbol; and

the frequency offset as a function of the predicted sample phase offset for each data signal sample.

52. The method of claim 51, further comprising:

generating the predicted phase offset;

generating an estimated phase offset for each data signal as a function thereof;

receiving estimated phase offsets and generating the predicted phase offset for each data symbol as a function of the estimated phase offset thereof and the estimated phase offset of a preceding one of the data symbols.

53. A method of operating a radio receiver system comprising:

receiving plural modulated radio frequency carriers and producing therefrom a modulated base-band signal, the plural modulated radio frequency carriers having been transmitted by a radio transmitter operating in accordance with a transmitter sample clock;

using a receiver sample clock for sampling the modulated base-band signal;

generating a frequency offset estimation;

using the frequency offset estimation to determine an estimated relative sample clock offset, the estimated relative sample clock offset being an offset between the receiver sample clock and the transmitter sample clock.

54. The method of claim 53, further comprising determining a timing drift during a sleep period of a predetermined duration.

55. The method of claim 54, further comprising determining a time until which the receiver is to sleep.

56. The method of claim 54, further comprising determining a time until which the receiver is to search for a start of a frame.

57. The method of claim 54, further comprising determining a size of a start of frame search window.

58. The method of claim 53, wherein the plural modulated radio frequency carriers have been modulated using Orthogonal Frequency Division Multiplexing (OFDM).